TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 288

THE REACTION ON A FLOAT BOTTOM WHEN MAKING CONTACT WITH WATER AT HIGH SPEEDS

By H. C. Richardson
Bureau of Aeronautics, Navy Department

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Mr. Carroll's observations in Technical Note No. 287 are quite new to me, and very interesting in the light of our Model Basin tests. As an explanation of the observed phenomenon, I would suspect an initial suction which, combined with down elevator, starts rotation and throws the bow deep. The suddenly increased displacement combined with the lift on the elevators then supplies the lift for the "bounce" before the rotation can be checked. This analysis is borne out by Model Basin tests made at the Washington Navy Yard, and given in the Appendix. These tests were made to investigate the possibility of a serious accident arising from unintentional contact with the water in substantially horizontal flight at high speed. Referring to the vector diagrams on Figure 2, it will be seen that a very dangerous condition may arise if the float be allowed to come in contact with the water at high speeds as, for example, when flying at high speed just above the surface of the water. The initial diving moment due to suction and drag combined may be great enough to cause the seaplane to nose under before the pilot is able to control the motion.

The same test data indicate clearly the existence of forces and moments tending to produce the phenomenon observed by Mr. Carroll, when the maneuver is carried out at lower speeds, as in a landing. The first effect of reducing the trim to about 0° by the stern in a landing is to set up a fairly large diving moment due to suction and resistance. The bow of the float then dips down, the displacement is suddenly increased and the resultant force is directed upward, throwing the seaplane clear. All of this will happen very quickly so that it is quite probable that the rotation will be unchecked.

I would like to emphasize the fact that it may be very dangerous to fly at low angles of attack and high speeds just above the surface of the water. In this position an accidental contact with the surface of the water may lead to a serious crash.

Bureau of Aeronautics,

February 20, 1928.

Appendix

1. Purpose of test.- The purpose of the experiments was to determine the direction and approximate value of the water reaction on the bottom of a float forward of the step, when making contact with the water at high speed, and trimmed by the bow.

2. Method of testing.- Model No. 2426, original VT design was used for the tests. The method used to measure the different forces is illustrated in Figure 5. The center of gravity about which moments were taken was established for a normal trim of 3° by the stern, and gross load of 2.63 lb. (8615 lb. F.S.). It was found that without any load on the model the carriage vibrations would cause the model to skip along the surface so that no definite measurements could be obtained. The model was then given a load of .1 lb., and tested at 0°, 1° by the bow, and 2° by the bow, over a range of speed from 10 to 13.5 knots. In each case the position of the level indicator, corresponding to .1 lb. load, was noted with the model at rest, and during the run kept at the same position. In this way the down pull on the model was measured by the spring balance without permitting the model to change level. Resistance and moments were measured in the usual manner. Similar tests were run with a load of .3 lb.

3. Arrangement of data.- On Figures 1 and 2 there are plotted on speed as a base, curves of resistance, vertical pull, and moments applied. The curves of pull do not include the initial load. On Figures 3 and 4 there are plotted the resultant forces derived from the resistance, vertical pull, and moments.

4. Comments.- The results show a definite downward pull on the float which increases with increase in speed. The greatest pull was measured with the floats at 0° trim, and the least at 2° trim by the bow.

The curves of resistance plot in the same order.

The moment curves on the lighter load show the greatest diving moment at 0° trim, and least at 2° by the bow. With the heavier load the order reverses, the greatest diving moment being obtained at 2° trim by the bow, and the least at 0°.

U. S. Experimental Model Basin,
Navy Yard, Washington, D. C.,
February, 1927.

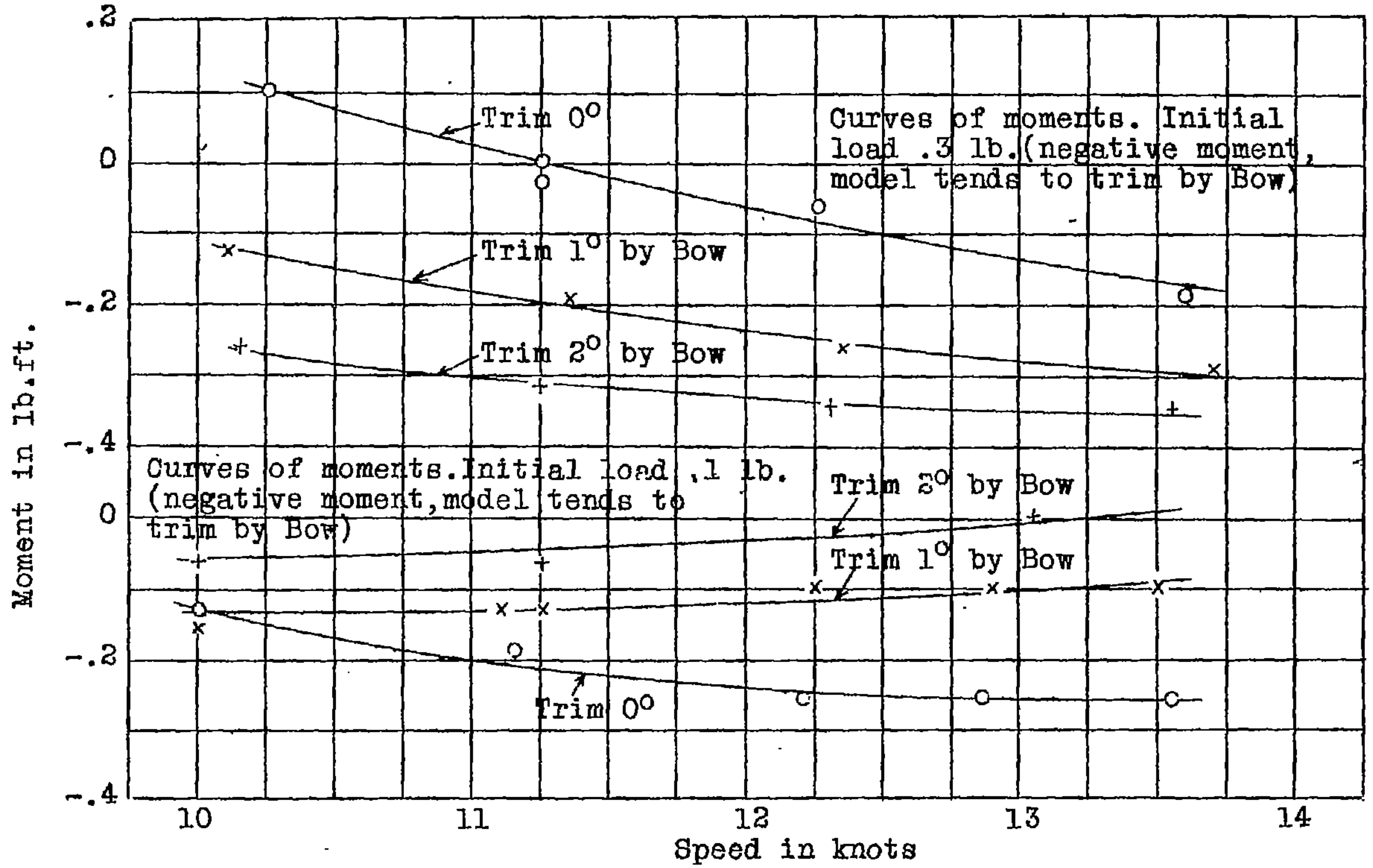

Fig.1 Model No.2426-VT twin floats,original design. Moments,resistance and vertical pull at constant load. Draft on run maintained same as draft at rest.

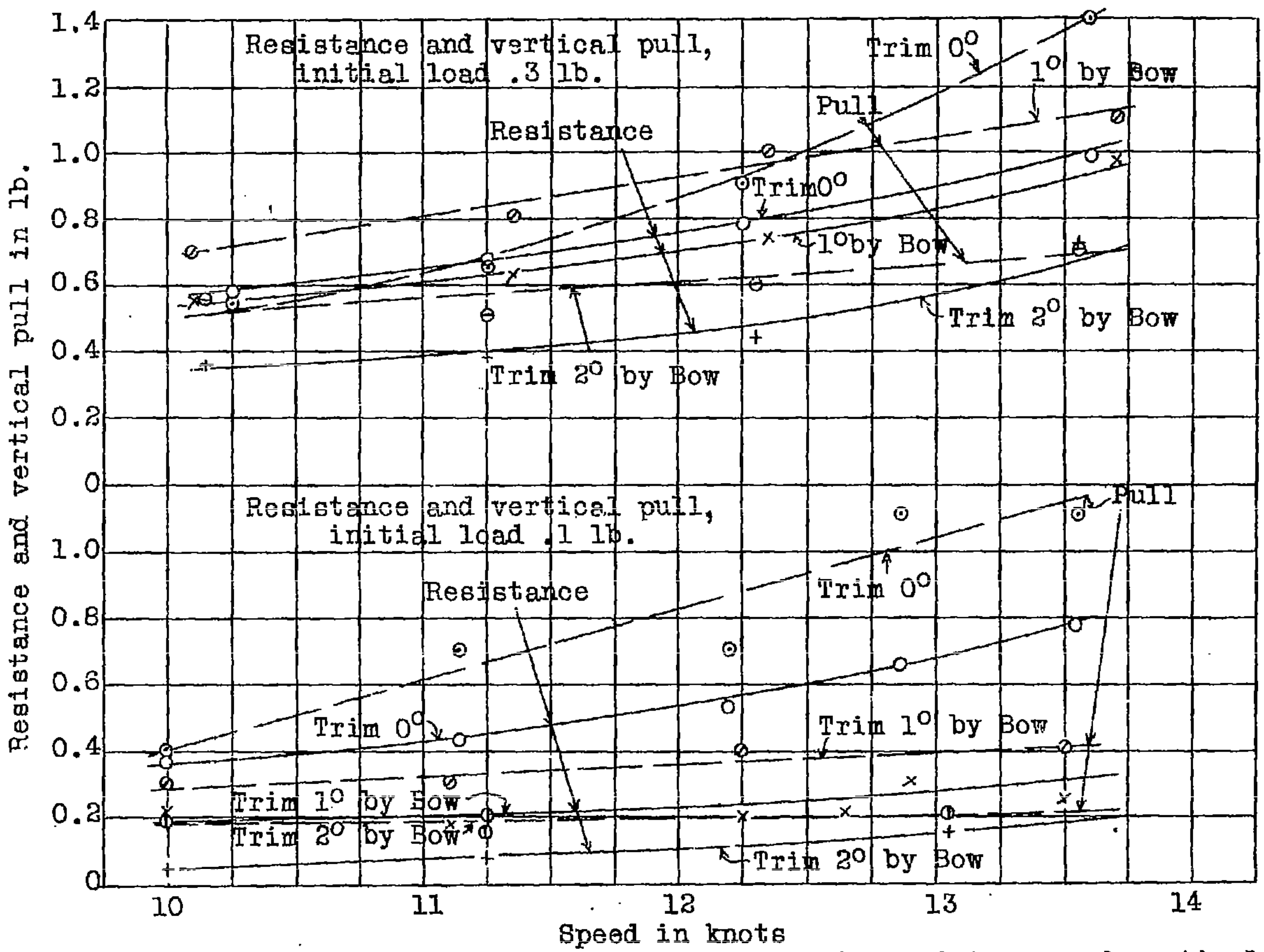

Fig.2 Model No.2426-VT twin floats, original design. Moments, resistance and vertical pull at constant load. Draft on run maintained same as draft at rest.

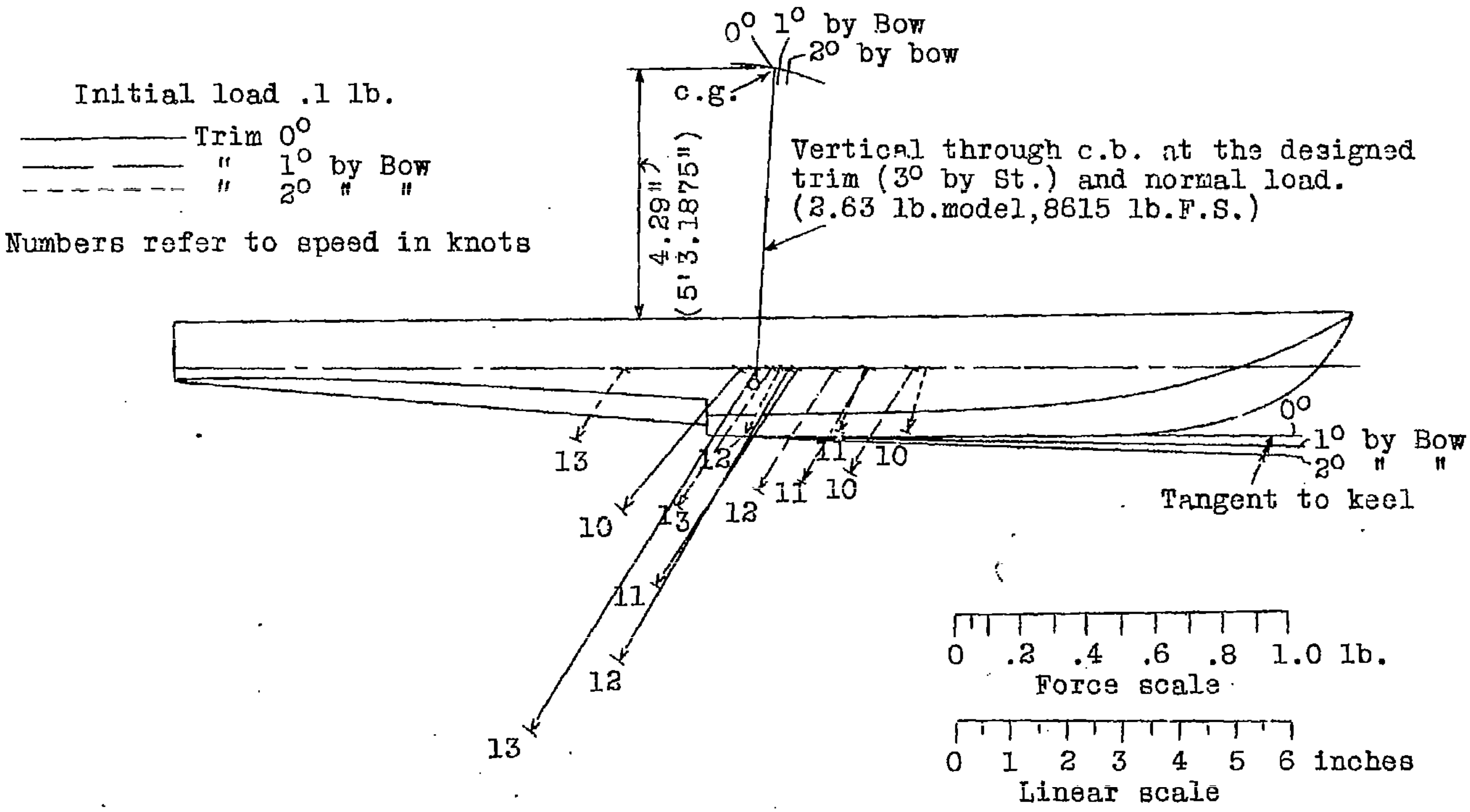

Fig.3 Model No.2426-VT twin floats,original design. Resultant forces at constant load. Draft constant during run.

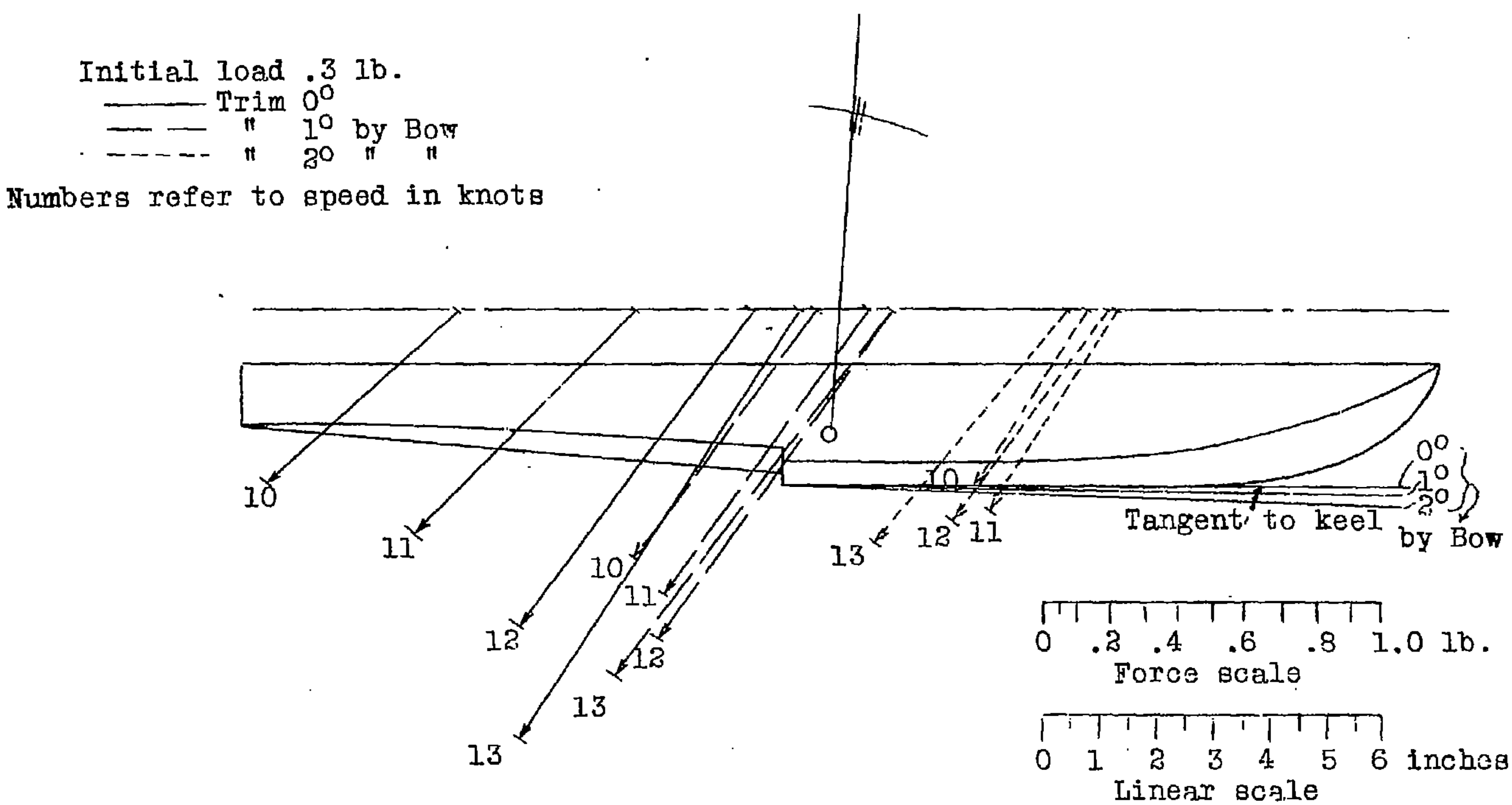

Fig.4 Model No.2426-VT twin floats, original design. Resultant forces at constant load. Draft constant during run.

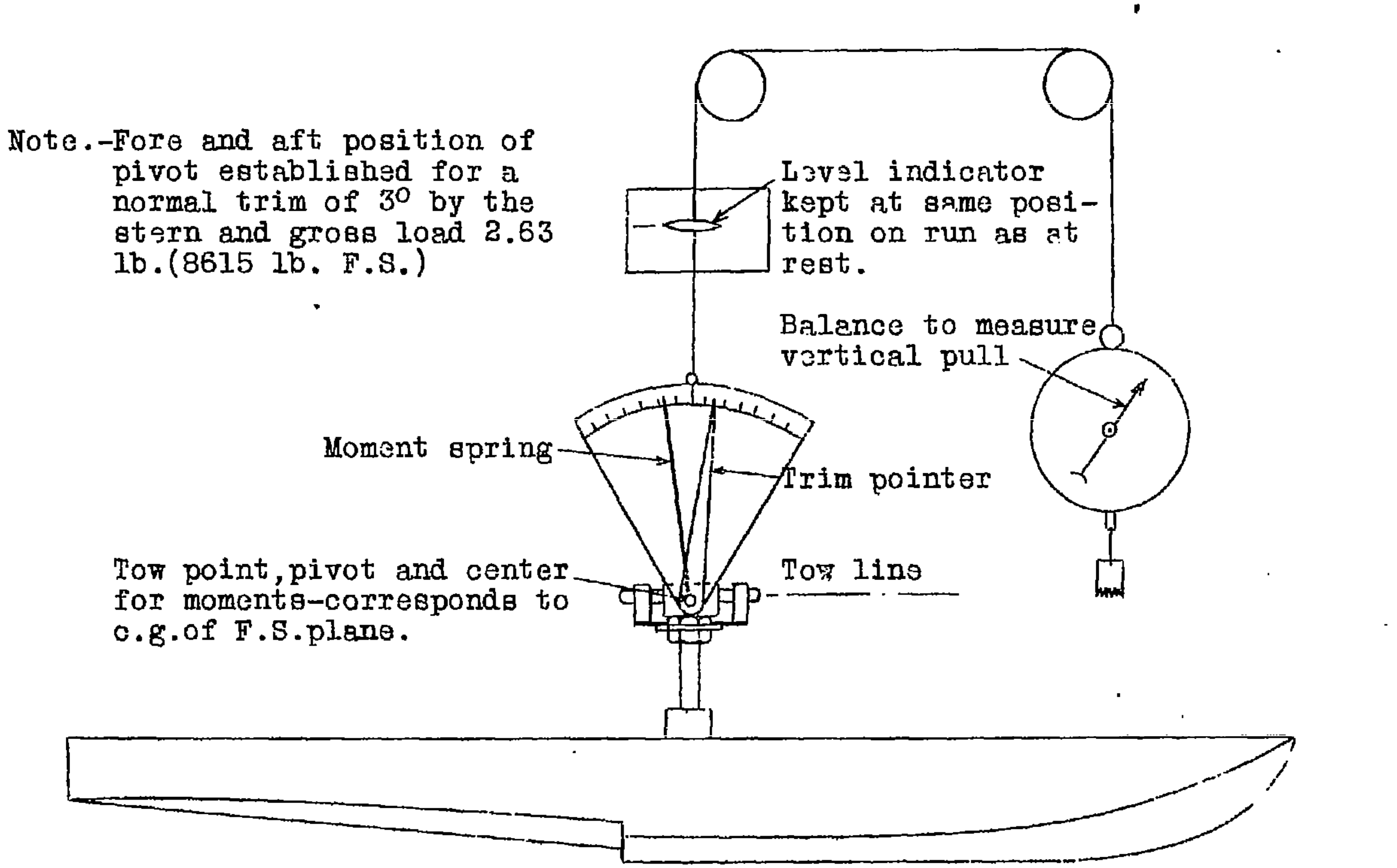

Fig.5 Model No.2426-VT twin floats,original design.Sketch showing method used to determine the reaction of water of the float bottom.